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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/719,041	11/21/2003	Brent J. Bollman	NSL-017	2810

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EXAMINER	
DOTY, HEATHER ANNE	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 03/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/719,041	BOLLMAN ET AL.	
	Examiner	Art Unit	
	Heather A. Doty	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☒ Claim(s) *11* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 November 2003 and 17 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities: On page 1, line 6, no application serial number or filing date is provided for the commonly-assigned, copending application whose disclosure is incorporated by reference.

Appropriate correction is required.

Claim Objections

Claim 11 is objected to because of the following informalities: In line one, "includes chloroform" should be removed. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 10 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 10 and 19, each of the phrases "e.g." and "and/or" separately renders the claims indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 5, 6, 7, and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Haggenmueller et al. (Chemical Physics Letters 330, 2000).

With respect to claims 1, 2, 5, 6, 7, and 9, Haggenmueller et al. teaches a method of infiltrating an organic material (the small-molecule polymer—further limited by claims 7 and 9—PMMA, pg. 220, second full paragraph) into and between carbon nanotubes—further limited by claim 5—(pg. 220, third full paragraph), comprising disposing the organic material proximate the nanostructures and exposing the organic material to a solvent vapor (pg. 220, fourth full paragraph teaches that the PMMA was mixed with a solvent, dimethylformamide, to create a polymer process solution—further limited by claim 2—, mixed with carbon nanotubes—further limited by claim 6—, and dried at 20 °C, which evaporated the solvent and thereby exposed the organic material, PMMA, to solvent vapors.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lahiff et al. (Nano Letters Vol. 3, No. 10, 2003) in view of Evans et al. (US 2004/0010048).

With respect to claim 1, Lahiff et al. teaches a method for infiltrating an organic material (organic polymer) into spaces in one or more nanostructures (inside and between carbon nanotubes) comprising disposing the organic material proximate the nanostructures (pg. 1334, last paragraph – pg. 1335, first paragraph).

Lahiff et al. does not teach exposing the organic material to a solvent vapor.

Evans et al. expressly teaches that solvent vapors penetrate and plasticize polymers without the addition of high heat (paragraph 21).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of Lahiff et al. and Evans et al. to infiltrate the organic material into and between the nanotubes, as taught by Lahiff et al., by exposing the organic material to a solvent vapor, as taught by Evans at al. The motivation for doing so at the time of the invention would have been to plasticize and therefore infiltrate the organic material into the nanostructured template at low temperatures, as noted above and expressly taught by Evans et al.

With respect to claim 2, Lahiff et al. and Evans et al. together teach the method of claim 1 (note 35 U.S.C. 103(b) rejection above). Lahiff et al. further teaches disposing the organic material proximate the nanostructures including disposing a layer of a polymer process solution on a nanostructured template (pg. 1334, last paragraph – pg. 1335, first paragraph).

With respect to claim 3, Lahiff et al. and Evans et al. together teach the method of claim 2. Lahiff et al. further teaches a nanostructured template with spaces between about 5 nm and about 1000 nm wide (Fig. 4, pg. 1336).

With respect to claim 5, Lahiff et al. and Evans et al. together teach the method of claim 1. Lahiff et al. further teaches that the nanostructures include one or more interstitial spaces between nanotubes (Fig. 4, pg. 1336).

With respect to claim 9, Lahiff et al. and Evans et al. together teach the method of claim 1 (note 35 U.S.C. 103(b) rejection above). Lahiff et al. further teaches that the organic material is a polymer (poly(dimethylsiloxane), pg. 1333, third paragraph), which is a small molecule.

Claims 6, 7, 8, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over McCarthy et al. (Synthetic Materials 121, 2001) in view of Evans et al. (US 2004/0010048).

With respect to claim 6, McCarthy et al. teaches a method of infiltrating a polymer material inside and between carbon nanotubes, wherein disposing the organic material proximate the nanotubes includes mixing the nanotubes into a polymer process solution (pg. 1225, second paragraph). McCarthy et al. does not teach exposing the organic material to a solvent vapor.

Evans et al. expressly teaches that solvent vapors penetrate and plasticize polymers without the addition of high heat (paragraph 21).

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to infiltrate the organic material into and between the nanotubes

by mixing the nanotubes into a polymer process solution as in claim 6 and as taught by McCarthy et al., and by exposing the organic material to a solvent vapor, as taught by Evans at al., to arrive at the invention as specified in claim 6. The motivation for doing so at the time of the invention would have been to plasticize and therefore infiltrate the organic material into the nanostructured template at low temperatures, as noted above and expressly taught by Evans et al.

With respect to claims 7 and 8, McCarthy et al. and Evans et al. together teach the method of claim 1, as noted the 35 U.S.C. 103(b) rejection of claim 6 above. McCarthy et al. further teaches that the organic material is a poly(phenylene vinylene) derivative, which is known to luminesce a blue color (see paragraph 135 of U.S. 2003/0206332), and is therefore considered a pigment or dye, which is considered a small molecule (Specification, pg. 2, line 13).

With respect to claim 10, McCarthy et al. and Evans et al. together teach the method of claim 1, as noted the 35 U.S.C. 103(b) rejection of claim 6 above. McCarthy et al. further teaches that the organic material is a polymer, as taught by claim 9, more specifically, a poly(phenylene vinylene) derivative (PmPV, page 1225, second paragraph), which is included in the claimed list.

With respect to claim 11, McCarthy et al. and Evans et al. together teach the method of claim 10, as noted above. Evans et al. further teaches that the solvent vapor is acetone (paragraph 64), which is included in the claimed list.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lahiff et al. (U.S. 6,630,772) in view of Evans et al. (US 2004/0010048), and further in view of Bower et al. (U.S. 6,630,772).

Together Lahiff et al. and Evans et al. teach the method of claim 2 (note 35 U.S.C. 103(a) rejection above). They do not teach that the spaces in the nanostructured template include tubes between about 1 nm and about 1000 nm in diameter with a tube density between about 10^{12} tubes/m^2 and about 10^{16} tubes/m^2.

Bower et al. teaches a method of infiltrating a polymer into and between carbon nanotubes (column 12, lines 1-5), wherein the tubes have diameters of 100 nm (column 9, line 42) and a tube density of at least 100 tubes/μm^2 (column 9, lines 43-44), which is 10^{14} tubes/m^2.

Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the infiltration method taught by Lahiff et al. and Evens et al. with the nanotube system taught by Bower et al. to obtain the invention as specified in claim 4. The motivation for doing so at the time of the invention would have been to create an electron emitter device, as taught by Bower et al. (column 9, line 34).

Claims 12-14, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lahiff et al. (Nano Letters Vol. 3, No. 10, 2003), in view of Evans et al. (U.S. 2004/0010048) and Bower et al. (U.S. 6,630,772).

With respect to claim 12, Lahiff et al. teaches a method of making a device comprising providing a nanostructured template having spaces between one or more nanostructures and infiltrating an organic material into the spaces by disposing the

organic material proximate the nanostructures (pg. 1334, last paragraph – pg. 1335, first paragraph). Lahiff et al. does not teach exposing the organic material to a solvent vapor and placing the nanostructured template or organic material in electrical contact with an electrode.

Evans et al. expressly teaches that solvent vapors penetrate and plasticize polymers without the addition of high heat (paragraph 21).

Bower et al. teaches forming an electrode adjacent to a carbon nanotube film (column 9, lines 17-18) to form an electron emitter display device.

Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to infiltrate the organic material into and between the nanotubes, as taught by Lahiff et al., by exposing the organic material to a solvent vapor, as taught by Evans at al. The motivation for doing so at the time of the invention would have been to plasticize and therefore infiltrate the organic material into the nanostructures at low temperatures, as noted above and expressly taught by Evans et al.

Additionally, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to form an electrode in electrical contact with the nanotubes or organic material, as taught by Bower et al. The motivation for doing so at the time of the invention would have been to excite electron emission, as taught by Bower et al. (column 9, line 18).

With respect to claim 13, Lahiff et al., Evans et al., and Bower et al. together teach the method of claim 12. Lahiff et al. further teaches that disposing the organic material proximate the nanostructures includes disposing a layer of an organic process

solution on a nanostructured template (pg. 1334, last paragraph – pg. 1335, first paragraph).

With respect to claim 14, Lahiff et al., Evans et al., and Bower et al. together teach the method of claim 12. Bower et al. further teaches a method of infiltrating a polymer into and between carbon nanotubes (column 12, lines 1-5), wherein the tubes have diameters of 100 nm (column 9, line 42) and a tube density of at least 100 tubes/μm^2 (column 9, lines 43-44), which is 10^{14} tubes/m^2.

With respect to claim 18, Lahiff et al., Evans et al., and Bower et al. together teach the method of claim 12. Lahiff et al. further teaches that the organic material is a polymer (poly(dimethylsiloxane), pg. 1333, third paragraph).

With respect to claim 20, Lahiff et al., Evans et al., and Bower et al. together teach the method of claim 12. Evans et al. further teaches that the solvent vapor is acetone (paragraph 64), which is included in the claimed list.

Claims 15, 16, 17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over McCarthy et al. (Synthetic Materials 121, 2001) in view of Evans et al. (US 2004/0010048) and Bower et al. (U.S. 6,630,772).

With respect to claim 19, McCarthy et al. teaches a method of infiltrating a polymer material inside and between carbon nanotubes (pg. 1225, second paragraph). McCarthy et al. further teaches that the organic material is a polymer, a poly(phenylene vinylene) derivative (PmPV, page 1225, second paragraph), which is included in the claimed list. McCarthy et al. does not teach exposing the organic material to a solvent

vapor or placing the nanostructured template or organic material in electrical contact with an electrode.

Evans et al. expressly teaches that solvent vapors penetrate and plasticize polymers without the addition of high heat (paragraph 21).

Bower et al. teaches forming an electrode adjacent to a carbon nanotube film (column 9, lines 17-18) to form an electron emitter display device.

Therefore, at the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of McCarthy et al. and Evans et al. to infiltrate the organic material into and between the nanotubes, wherein the organic material is a poly(phenylene vinylene) derivative, as taught by McCarthy et al., by exposing the organic material to a solvent vapor, as taught by Evans at al. The motivation for doing so at the time of the invention would have been to plasticize the organic material at low temperatures, as noted above and expressly taught by Evans et al.

Additionally, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to form an electrode in electrical contact with the nanotubes or organic material, as taught by Bower et al. The motivation for doing so at the time of the invention would have been to excite electron emission, as taught by Bower et al. (column 9, line 18).

With respect to claims 15 and 17, McCarthy et al., Evans et al., and Bower et al. together teach the method of claim 12. McCarthy further teaches that the organic material is a poly(phenylene vinylene) derivative, which is known to luminesce a blue

color (see paragraph 135 of U.S. 2003/0206332), and is therefore considered a pigment or dye, which is considered a small molecule (Specification, pg. 2, line 13).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ren et al. (U.S. 2003/0203139) in view of Evans et al. (U.S. 2004/0010048) and Bower et al. (U.S. 6,630,772).

Ren et al. teaches a method for infiltrating an organic material into and between carbon nanotubes by disposing the organic material proximate the nanotubes, wherein the material is polyphenylene (paragraph 78), which is known to be a pentacene. Ren et al. does not teach exposing the organic material to a solvent vapor and placing the nanostructured template or organic material in electrical contact with an electrode.

Evans et al. expressly teaches that solvent vapors penetrate and plasticize polymers without the addition of high heat (paragraph 21).

Bower et al. teaches forming an electrode adjacent to a carbon nanotube film (column 9, lines 17-18) to form an electron emitter display device.

Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to infiltrate the organic material into and between the nanotubes, as taught by Ren et al., by exposing the organic material to a solvent vapor, as taught by Evans at al. The motivation for doing so at the time of the invention would have been to plasticize and therefore infiltrate the organic material into the nanostructures at low temperatures, as noted above and expressly taught by Evans et al.

Additionally, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to form an electrode in electrical contact with the nanotubes or

organic material, as taught by Bower et al. The motivation for doing so at the time of the invention would have been to excite electron emission, as taught by Bower et al. (column 9, line 18).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Heather A. Doty whose telephone number is (571) 272-8429. The examiner can normally be reached on M-F, 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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PRIMARY EXAMINER